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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/799,160	03/12/2004	Yung-Hoon Ha	17648-0026	9525

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SUTHERLAND ASBILL & BRENNAN LLP
999 PEACHTREE STREET, N.E.
ATLANTA, GA 30309

EXAMINER

LAMBELET, LAWRENCE EMILE

ART UNIT	PAPER NUMBER
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1732

DATE MAILED: 10/11/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/799,160

Applicant(s)

HA ET AL.

Examiner

Lawrence Lambelet

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED* (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 21 August 2006.
2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-44 is/are pending in the application.
4a) Of the above claim(s) _____ is/are withdrawn from consideration.
5) ☐ Claim(s) _____ is/are allowed.
6) ☒ Claim(s) 1-44 is/are rejected.
7) ☐ Claim(s) _____ is/are objected to.
8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____

DETAILED ACTION

Response to Amendment

Applicant's amendment to claims in the reply filed on 8/21/2006 is acknowledged. Non-elected claims 45-47 are cancelled. Claims 1-3, 5-7, and 18-20 are made of record as amended. Claims 1-44 are currently pending.

Election/Restrictions

Applicant's election with traverse of Group I, claims 1-44, in the reply filed on 8/21/2006 is acknowledged. The traversal is on the ground(s) that search of Groups I and II together would not be an undue burden. This is not found persuasive because Group I is classified under class 264, and Group II, under class 428. The showing of burden resides in the requirement for different fields of search.

The requirement is still deemed proper and is therefore made FINAL.

Applicant further elects, with traverse, bicontinuous networks from Species A and nonmetals from Species B. Claims 1-12, 15-32 and 35-44 have been identified as reading on the elected species. Claim 1 is identified as generic to both Species A and B. The traversal in this case is found persuasive and non-elected species claims 13-14 and 33-34 will be included in the examination on the merits.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-5, 7-8, 11-12, 15-25, 27-28, 31-32, and 35-44 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zakhidov et al (U.S. Patent 6,261,469).

Zakhidov et al, hereafter "Zakhidov", discloses a method of producing an inverse replica, as recited in claims 1-4, 23-25, and 43-44. Zakhidov teaches assembling spheres of a first material into an opal-like lattice and connecting the spheres with "necks" (bicontinuous structure) by sintering thereby leaving a percolated void space. Zakhidov further teaches infiltrating this space (second phase) with a second material (third phase) and removing the first material (first phase) to create an inverse replica (immobilized third phase). See lines 33-67 in column 6. Zakhidov still further teaches infiltrating a third material into the interstitial space of the inverse replica and removing the second material to form a direct replica. See lines 14-21 in column 7. The infiltrating materials are fluids. See lines 18-25 in column 12. It would have been obvious to one of ordinary skill to carry this pattern of infiltration and removal an additional step further to produce a second inverse replica.

Zakhidov teaches that a shrinking step can be accomplished with an infiltrated phenolic material by pyrolysis, as required by claims 1, 4, 20, 23, 40 and 44. See lines 40-67 in column 17. It would have been obvious to one of ordinary skill to use the

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phenolic material for either the second or third infiltrate thereby creating either a shrunken inverse replica or a shrunken direct replica.

Zakhidov teaches an opal-like matrix comprised of silica-coated polystyrene spheres (first solid phase) which shrink by 20-35% upon removal of the polystyrene by burning (pyrolysis) thereby leaving a shrunken silica template, as required by claim 43. See lines 20-32 in column 2.

Zakhidov teaches that the opal-like template has a face-centered cubic (ordered) arrangement, as required by claim 5. See lines 1-10 in column 11.

Zakhidov teaches that the unit cell contraction upon pyrolysis of the phenolic inverse replica is 20% or higher, as required by claims 7 and 27. See lines 63-76 in column 17.

Zakhidov teaches that a polymer precursor is used for an infiltrate (first or second fluid), as required by claims 8, 15, 28 and 35. See lines 40-45 in column 17. It would have been obvious to one of ordinary skill to use the same infiltrate a second time (i.e., both first and third fluids), as required by claims 16 and 36.

Zakhidov teaches an infiltrate composition as having a diblock polymer involving linkages, among others, of poly(dimethylsiloxane). See lines 59-63 in column 11. It would have been obvious to one of ordinary skill that the precursor to such a material would be dimethyl siloxane, as required by claims 11 and 31.

Zakhidov teaches that the infiltrate is immobilized by polymerization, as required by claims 12 and 32. See lines 40-45 in column 17.

Zakhidov teaches infiltration of polystyrene under vacuum into an opal-like template of SiO₂ spheres displacing air (second phase), as required by claims 17 and 37. See Example 4, lines 59-67 in column 29 and 1-5 in column 30.

Zakhidov teaches that an opal-like template (first phase) comprised of SiO₂ spheres is removed by dissolving in aqueous HF while leaving the infiltrate (third phase) in place, as required by claims 18 and 38. See lines 47-51 in column 17.

Zakhidov teaches removal of SiO₂ spheres (first phase) by KOH etch (chemical etching), as required by claims 19 and 39. See lines 28-38 in column 15.

Zakhidov teaches that an infiltrate composition (third phase) of polydimethylsiloxane, as required by claims 21 and 41. See lines 59-64 in column 11.

Zakhidov teaches that the infiltration of the second material (first fluid) can be done by chemical vapor deposition, as required by claims 22 and 42. See lines 1-5 in column 12.

Claims 6 and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zakhidov as applied to claims 1-5, 7-8, 11-12, 15-25, 27-28, 31-32, and 35-44 above, and further in view of Taboas et al (U.S. Patent Application Publication 2003/0006534).

Zakhidov teaches the method of claims 1-5, 7-8, 11-12, 15-25, 27-28, 31-32, and 35-44, as discussed above.

Zakhidov does not teach a bicontinuous structure formed by a molding process, a solid freeform fabrication (SFF) process, or a biological process, as required by claims 6 and 26.

Taboas et al, hereafter "Taboas", teaches fabrication of a "mold", having a porous structure (bicontinuous) wherein an inverse replica is cast, by 3D printing (SFF technique). See paragraph [0058].

Zakhidov and Taboas are combinable because they are concerned with a similar technical field, namely, forming macroporous structures for templing. One of ordinary skill in the art at the time of the invention would have found it obvious to include in the method of Zakhidov the scaffold fabrication technique, as taught by Taboas. The motivation to do so would have been the enhancement of control over pore size and interconnectivity in forming a bicontinuous structure. See paragraph [0015] of Toboas.

Claims 9-10, 13-14, 29-30, and 33-34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zakhidov in view of Taboas as applied to claims 1-8, 11-12, 15-28, 31-32, and 35-44 above, and further in view of Narang et al (U.S. Patent 5,980,813).

Zakhidov and Taboas teach the method of claims 1-8, 11-12, 15-28, 31-32, and 35-44, as discussed above.

Zakhidov and Taboas do not teach composition of the polymer precursor as an organometallic, as required by claims 9 and 29, or a polysilazane, as required by claims 10 and 30. Zakhidov and Taboas further do not teach molten metal or semi-metal as an infiltration fluid material, as required by claims 13 and 33, or that immobilization of the metal is accomplished by freezing, as required by claims 14 and 34.

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Narang et al, hereafter "Narang", teaches a build material as a metal covalently bound to a polymeric precursor (organometallic). See lines 48-60 in column 3.

Narange further teaches a build material as a polymerizable silazane at lines 40-45 in column 6. Narang still further teaches a metal build material applied in a molten state thereafter to solidify by freezing. See lines 1-12 in column 13.

Zakhidov, Taboas and Narang are combinable because they are concerned with a similar technical field, namely, SFF-directed structures. One of ordinary skill in the art at the time of the invention would have found it obvious to include in the method of Zakhidov and Taboas the unique materials of Narang. The motivation to do so would have been to expand the field of application by providing electrical, thermal, and magnetic conducting paths within a bicontinuous structure. See lines 47-57 in column 2 of Narang.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. The following documents are cited to further show the state of the art with regard to templated 3D networks:

U.S. Patent 6,139,626 to Norris et al

U.S. Patent 6,858,079 to Norris et al

U.S. Patent 6,991,847 to Padmanabhan et al

U.S. Patent 6,433,931 to Fink et al

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Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lawrence Lambelet whose telephone number is 571-272-1713. The examiner can normally be reached on 8 am-4:30 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Christina Johnson can be reached on 571-272-1176. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

LEL
9/28/2006


CHRISTINA JOHNSON
PRIMARY EXAMINER

10/2/06